Agency for Healthcare Research and Quality
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NATIONAL GUIDELINE CLEARINGHOUSE

General

Guideline Title

Congress of Neurological Surgeons systematic review and evidence-based guidelines on intraoperative cranial nerve monitoring in vestibular schwannoma surgery.

Bibliographic Source(s)

Vivas EX, Carlson ML, Neff BA, Shepard NT, McCracken DJ, Sweeney AD, Olson JJ. Congress of Neurological Surgeons systematic review and evidence-based guidelines on intraoperative cranial nerve monitoring in vestibular schwannoma surgery. Neurosurgery. 2018 Feb 1;82(2):E44-6. PubMed

Guideline Status

This is the current release of the guideline.

This guideline meets NGC's 2013 (revised) inclusion criteria.

NEATS Assessment

National Guideline Clearinghouse (NGC) has assessed this guideline's adherence to standards of trustworthiness, derived from the Institute of Medicine's report Clinical Practice Guidelines We Can Trust.

= Poor = Fair = Good = Very Good = Excellent

Assessment	Standard of Trustworthiness
YES	Disclosure of Guideline Funding Source
	Disclosure and Management of Financial Conflict of Interests
	Guideline Development Group Composition
YES	Multidisciplinary Group
UNKNOWN	Methodologist Involvement

	Patient and Public Perspectives
	Use of a Systematic Review of Evidence
	Search Strategy
	Study Selection
	Synthesis of Evidence
	Evidence Foundations for and Rating Strength of Recommendations
	Grading the Quality or Strength of Evidence
	Benefits and Harms of Recommendations
	Evidence Summary Supporting Recommendations
	Rating the Strength of Recommendations
	Specific and Unambiguous Articulation of Recommendations
	External Review
	Updating

Recommendations

Major Recommendations

Definitions for the classification of evidence (I-III) and levels of recommendations (1-3) are provided at the end of the "Major Recommendations" field.

Facial Nerve Monitoring

Question 1

Does intraoperative facial nerve monitoring during vestibular schwannoma surgery lead to better long-term facial nerve function?

Target Population

This recommendation applies to adult patients undergoing vestibular schwannoma surgery regardless of tumor characteristics.

Recommendation

Level 3: It is recommended that intraoperative facial nerve monitoring be routinely utilized during vestibular schwannoma surgery to improve long-term facial nerve function.

Question 2

Can intraoperative facial nerve monitoring be used to accurately predict favorable long-term facial nerve

function after vestibular schwannoma surgery?

Target Population

This recommendation applies to adult patients undergoing vestibular schwannoma surgery.

Recommendation

Level 3: Intraoperative facial nerve monitoring can be used to accurately predict favorable long-term facial nerve function after vestibular schwannoma surgery. Specifically, the presence of favorable testing reliably portends a good long-term facial nerve outcome. However, the absence of favorable testing in the setting of an anatomically intact facial nerve does not reliably predict poor long-term function and therefore cannot be used to direct decision-making regarding the need for early reinnervation procedures.

Question 3

Does an anatomically intact facial nerve with poor electromyogram (EMG) electrical responses during intraoperative testing reliably predict poor long-term facial nerve function?

Target Population

This recommendation applies to adult patients undergoing vestibular schwannoma surgery.

Recommendation

Level 3: Poor intraoperative EMG electrical response of the facial nerve should not be used as a reliable predictor of poor long-term facial nerve function.

Cochlear Nerve Monitoring

Question 4

Should intraoperative eighth cranial nerve monitoring be used during vestibular schwannoma surgery?

Target Population

This recommendation applies to adult patients undergoing vestibular schwannoma surgery with measurable preoperative hearing levels and tumors smaller than 1.5 cm.

Recommendation

Level 3: Intraoperative eighth cranial nerve monitoring should be used during vestibular schwannoma surgery when hearing preservation is attempted.

Question 5

Is direct monitoring of the eighth cranial nerve superior to the use of far-field auditory brain stem responses?

Target Population

This recommendation applies to adult patients undergoing vestibular schwannoma surgery with measurable preoperative hearing levels and tumors smaller than 1.5 cm.

Recommendation

Level 3: There is insufficient evidence to make a definitive recommendation.

Definitions

American Association of Neurological Surgeons/Congress of Neurological Surgeons Classification of Evidence on Prognosis and Levels of Recommendation

To evaluate papers addressing *prognosis*, 5 technical criteria are applied:

Was a well-defined representative sample of patients assembled at a common (usually early) point in the course of their disease?
Was patient follow-up sufficiently long and complete?
Were objective outcome criteria applied in a "blinded" fashion?
If subgroups with different prognoses were identified, was there adjustment for important prognostic factors?
If specific prognostic factors were identified, was there validation in an independent "test set" group of patients?

Class I Evidence Level 1 Recommendation	All 5 technical criteria above are satisfied
Class II Evidence Level 2 Recommendation	Four of 5 technical criteria are satisfied
Class III Evidence Level 3 Recommendation	Everything else

Clinical Algorithm(s)

None provided

Scope

Disease/Condition(s)

Vestibular schwannomas

Guideline Category

Evaluation

Management

Clinical Specialty

Neurological Surgery

Neurology

Otolaryngology

Intended Users

Physicians

Guideline Objective(s)

To critically assess the existing literature and provide an evidence-based clinical practice guideline regarding the use of intraoperative cranial nerve monitoring (ICNM) during vestibular schwannoma (VS) surgery

Target Population

Adult patients undergoing vestibular schwannoma surgery

Interventions and Practices Considered

Intraoperative cranial nerve monitoring (ICNM)

Note: The following was considered but not recommended: use of intraoperative electromyogram (EMG) electrical response of the facial nerve as a predictor of long-term facial nerve function.

Major Outcomes Considered

- Long-term facial nerve function
- Hearing preservation rates

Methodology

Methods Used to Collect/Select the Evidence

Hand-searches of Published Literature (Primary Sources)

Hand-searches of Published Literature (Secondary Sources)

Searches of Electronic Databases

Description of Methods Used to Collect/Select the Evidence

Process Overview

The evidence-based clinical practice guideline taskforce members and the Tumor Section of the American Association of Neurological Surgeons and the Congress of Neurological Surgeons (CNS) conducted a systematic review of the literature relevant to the management of vestibular schwannomas (VSs). The PubMed, EMBASE, and Web of Science databases were queried. The keywords used during the search of the medical literature databases cited above are documented in Tables 1 and 2 in the full guideline (see the "Availability of Companion Documents" field).

Article Inclusion/Exclusion Criteria

Citations were manually reviewed by the team with specific inclusion and exclusion criteria as outlined below. The duplicates from the search were eliminated. Two independent reviewers reviewed and abstracted full-text data for each article, and the 2 sets of data were compared for agreement by a third party. Inconsistencies were re-reviewed and disagreements were resolved by consensus. The evolution of the article selection is illustrated with flow diagrams (see Figures 1 and 2 in the full guideline). All citations that focused on adult patients and surgical treatment of VSs were broadly considered. For literature to be included for further consideration, papers had to meet the following criteria:

General

Investigated patients suspected of having vestibular schwannomas
Was of humans
Was not an in vitro study
Was not a biomechanical study
Was not performed on cadavers

Published between January 1, 1990 and December 31, 2014
Published in a peer-reviewed journal
Was not a meeting abstract, editorial, letter, or commentary
Was published in English
Included quantitatively presented results

Specific

Used an established facial nerve (FN) function grading system, such as the House–Brackmann (HB) scale or the Sunnybrook (SB) scale
Used the 1995 American Academy of Otolaryngology-Head and Neck Surgery (AAO-HNS) or Gardner–Robertson (GR) hearing classification system OR presented data using word recognition score (WRS) and pure tone average (PTA) for defining hearing status or had individual patient data presented such that the latter criteria could be applied and analyzed
Included pre- and postoperative audiometric data
Included a median or mean follow-up of 12 months following treatment when assessing long-term facial outcomes
Included only studies evaluating intraoperative electrophysiological testing of the facial and cochlear nerves
Used electrically evoked testing with EMG
NF status was collected when available but was not an exclusion criterion

The authors did not include systematic reviews, guidelines, or meta-analyses conducted by others. These documents were developed using different inclusion criteria than those specified in our guideline. Therefore, they may have included studies that do not meet the inclusion criteria listed above. These documents were recalled if their abstract suggested that they might address one of the recommendations set forth in this guideline. The authors searched their bibliographies for additional studies.

Search Strategies

The task force collaborated with a medical librarian to search for articles published between January 1, 1990 and December 31, 2014. Three electronic databases were searched: PubMed, EMBASE, and Web of Science. Strategies for searching electronic databases were constructed by the evidence-based clinical practice guideline taskforce members and the medical librarian using previously published search strategies to identify relevant studies (see Tables 1 and 2 in the full guideline).

Searches of electronic databases were supplemented with manual screening of the bibliographies of all retrieved publications. Bibliographies of recent systematic reviews and other review articles for potentially relevant citations were also searched. All articles identified were subject to the study selection criteria listed above. The guideline committee also examined lists of included and excluded studies for errors and omissions. The guideline task force went to great lengths to obtain a complete set of relevant articles to ensure guideline recommendations are not based on a biased subset of articles. Two datasets were constructed, one for FN monitoring and another for cochlear nerve monitoring.

Number of Source Documents

Facial Nerve Monitoring

Twenty-one articles were included as evidence (see Table 1 and Figure 1 in the full guideline [see the "Availability of Companion Documents" field]).

Cochlear Nerve Monitoring

Seven articles were included as evidence (see Table 2 and Figure 2 in the full guideline).

Methods Used to Assess the Quality and Strength of the Evidence

Weighting According to a Rating Scheme (Scheme Given)

Rating Scheme for the Strength of the Evidence

American Association of Neurological Surgeons/Congress of Neurological Surgeons Classification of Evidence on Prognosis and Levels of Recommendation

To evaluate papers addressing *prognosis*, 5 technical criteria are applied:

> Was a well-defined representative sample of patients assembled at a common (usually early) point in the course of their disease?
> Was patient follow-up sufficiently long and complete?
> Were objective outcome criteria applied in a "blinded" fashion?
> If subgroups with different prognoses were identified, was there adjustment for important prognostic factors?
> If specific prognostic factors were identified, was there validation in an independent "test set" group of patients?

Class I Evidence Level 1 Recommendation	All 5 technical criteria above are satisfied
Class II Evidence Level 2 Recommendation	Four of 5 technical criteria are satisfied
Class III Evidence Level 3 Recommendation	Everything else

Methods Used to Analyze the Evidence

Systematic Review with Evidence Tables

Description of the Methods Used to Analyze the Evidence

Data Analysis

Evidence tables for the use of intraoperative cochlear nerve monitoring and facial nerve (FN) monitoring were constructed using key study parameters as outlined above.

Facial Nerve

Data extraction included study design, level of evidence, total number of patients, pre- and posttreatment facial function, study selection parameters, tumor characteristics, mean or median follow-up, neurofibromatosis type 2 status, and prognostic parameters associated with short- and long-term facial function.

Cochlear Nerve

Data extraction included study design, level of evidence, total number of patients, pre- and posttreatment hearing status, study selection parameters, tumor characteristics, mean or median follow-up, neurofibromatosis type 2 status, and prognostic features associated with postoperative hearing preservation.

Methods Used to Formulate the Recommendations

Expert Consensus (Nominal Group Technique)

Description of Methods Used to Formulate the Recommendations

Classification of Evidence and Guideline Formulation

The concept of linking evidence to recommendations has been further formalized by the American Medical Association (AMA) and many specialty societies, including the American Association of Neurological Surgeons (AANS), the Congress of Neurological Surgeons (CNS), and the American Academy of Neurology (AAN). This formalization involves the designation of specific relationships between the strength of evidence and the strength of recommendations to avoid ambiguity. In the paradigm for prognostication used in this guideline, evidence is classified into 1 of 3 tiers based upon the degree at which the study fulfills 5 technical criteria as outlined in the "Rating Scheme for the Strength of the Evidence" field.

A basis for these guidelines can be viewed in Haines SJ and Nicholas JS (2006). Evidence-Based Medicine: A Conceptual Framework. In Haines SJ and Walters BC (Eds.), *Evidence-Based Neurosurgery: An Introduction* (Pages 1-17). New York: Thieme Medical Publishers.

Guideline Panel Consensus

Multidisciplinary writing groups were created for each section based on author expertise to address each of the disciplines and particular areas of therapy selected for these clinical guidelines. Each group was involved with literature selection, creation and editing of the evidence tables, and scientific foundations for their specific section and discipline. Using this information, the writing groups then drafted the recommendations in answer to the questions formulated at the beginning of the process, culminating in the clinical practice guideline for their respective discipline. The draft guidelines were then circulated to the entire clinical guideline panel to allow for multidisciplinary feedback, discussion, and ultimately approval.

Rating Scheme for the Strength of the Recommendations

See the "Rating Scheme for the Strength of the Evidence" field.

Cost Analysis

A formal cost analysis was not performed and published cost analyses were not reviewed.

Method of Guideline Validation

Internal Peer Review

Description of Method of Guideline Validation

Approval Process

The completed evidence-based clinical practice guidelines for the management of vestibular schwannomas (VSs) were presented to the Joint Guideline Committee (JGC) of the American Association of Neurological Surgeons (AANS) and the Congress of Neurological Surgeons (CNS) for review. The reviewers for the JGC were vetted by *Neurosurgery* for suitability and expertise to serve as reviewers for the purposes of publication in that journal also. The final product was then approved and endorsed by the executive committees of both the AANS and CNS before publication in *Neurosurgery*.

Evidence Supporting the Recommendations

Type of Evidence Supporting the Recommendations

The type of supporting evidence is identified and graded for each recommendation (see the "Major Recommendations" field).

Benefits/Harms of Implementing the Guideline Recommendations

Potential Benefits

- Improved long-term facial nerve function
- Hearing preservation

Potential Harms

False-positive or false-negative results of monitoring modalities

Qualifying Statements

Qualifying Statements

Disclaimer of Liability

This clinical systematic review and evidence-based guideline was developed by a multidisciplinary physician volunteer task force and serves as an educational tool designed to provide an accurate review of the subject matter covered. These guidelines are disseminated with the understanding that the recommendations by the authors and consultants who have collaborated in their development are not meant to replace the individualized care and treatment advice from a patient's physician(s). If medical advice or assistance is required, the services of a competent physician should be sought. The proposals contained in these guidelines may not be suitable for use in all circumstances. The choice to implement any particular recommendation contained in these guidelines must be made by a managing physician in light of the situation in each particular patient and on the basis of existing resources.

Implementation of the Guideline

Description of Implementation Strategy

An implementation strategy was not provided.

Implementation Tools

Quick Reference Guides/Physician Guides

For information about availability, see the *Availability of Companion Documents* and *Patient Resources* fields below.

Institute of Medicine (IOM) National Healthcare Quality

Report Categories

IOM Care Need

Living with Illness

IOM Domain

Effectiveness

Identifying Information and Availability

Bibliographic Source(s)

Vivas EX, Carlson ML, Neff BA, Shepard NT, McCracken DJ, Sweeney AD, Olson JJ. Congress of Neurological Surgeons systematic review and evidence-based guidelines on intraoperative cranial nerve monitoring in vestibular schwannoma surgery. Neurosurgery. 2018 Feb 1;82(2):E44-6. PubMed

Adaptation

Not applicable: The guideline was not adapted from another source.

Date Released

2018 Feb 1

Guideline Developer(s)

Congress of Neurological Surgeons - Professional Association

Source(s) of Funding

These evidence-based clinical practice guidelines were funded exclusively by the Congress of Neurological Surgeons, the Tumor Section of the Congress of Neurological Surgeons, and the American Association of Neurological Surgeons, which received no funding from outside commercial sources to support the development of this document.

Guideline Committee

Vestibular Schwannoma Evidence-Based Practice Guideline Task Force

Composition of Group That Authored the Guideline

Task Force Members: Esther X. Vivas, MD, Department of Otolaryngology–Head & Neck Surgery, Emory University School of Medicine, Atlanta, Georgia; Matthew L. Carlson, MD, Department of Otorhinolaryngology and Department of Neurosurgery, Mayo Clinic, School of Medicine, Rochester, Minnesota; Brian A. Neff, MD, Department of Otorhinolaryngology and Department of Neurosurgery, Mayo

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Financial Disclosures/Conflicts of Interest

Conflict of Interest

The Vestibular Schwannoma Guidelines Task Force members were required to report all possible conflicts of interest (COIs) prior to beginning work on the guideline, using the COI disclosure form of the American Association of Neurological Surgeons/Congress of Neurological Surgeons (AANS/CNS) Joint Guidelines Committee, including potential COIs that are unrelated to the topic of the guideline. The CNS Guidelines Committee and Guideline Task Force Chair reviewed the disclosures and either approved or disapproved the nomination. The CNS Guidelines Committee and Guideline Task Force Chair are given latitude to approve nominations of Task Force members with possible conflicts and address this by restricting the writing and reviewing privileges of that person to topics unrelated to the possible COIs. The conflict of interest findings are provided in detail in the full-text introduction and methods manuscript (see the "Availability of Companion Documents" field).

Guideline Endorser(s)

American Association of Neurological Surgeons - Medical Specialty Society

Guideline Status

This is the current release of the guideline.

This guideline meets NGC's 2013 (revised) inclusion criteria.

Guideline Availability

Available from the Neurosurgery Web site .

Availability of Companion Documents

The following are available:

Congress of Neurological Surgeons systematic review and evidence-based guidelines on intraoperative cranial nerve monitoring in vestibular schwannoma surgery. Full guideline. Schaumburg (IL): Congress of Neurological Surgeons (CNS); 2017 Dec 22. 67 p. Available from the Congress of Neurological Surgeons (CNS) Web site .

Congress of Neurological Surgeons systematic review and evidence-based guidelines on the treatment of adults with vestibular schwannomas: introduction and methods. Schaumburg (IL): Congress of Neurological Surgeons (CNS); 2017 Dec 22. 28 p. Available from the CNS Web site .

Olson JJ, Kalkanis SN, Ryken TC. Congress of Neurological Surgeons systematic review and evidence-based guidelines on the treatment of adults with vestibular schwannomas: executive summary. Neurosurgery. 2018 Feb 1;82(2):129-34. Available from the Neurosurgery Web site .

Congress of Neurological Surgeons (CNS). Guideline development methodology: endorsed by the American Association of Neurological Surgeons (AANS), the Congress of Neurological Surgeons (CNS), and the AANS/CNS Joint Guideline Committee. Schaumburg (IL): Congress of Neurological Surgeons (CNS); 2012 Feb. 12 p. Available from the CNS Web site .

Patient Resources

None available

NGC Status

This NGC summary was completed by ECRI Institute on May 7, 2018. The information was verified by the guideline developer on June 4, 2018.

This NEATS assessment was completed by ECRI Institute on April 25, 2018. The information was verified by the guideline developer on June 4, 2018.

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